

**ECE 405: Senior Design III**

**North Dakota State University**

**Homework 1: Requirements Capture 2.0**

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## **Requirements Capture**

### **Introduction**

Our design project focuses on creating a device for acquisition of data pertaining to available solar and wind power in a remote location. This data would be used to determine what types of off-grid renewable energy systems would work best for the location. There is information available on the web regarding weather patterns and available sunlight for certain regions, but this data can vary greatly from location to location within a small area due to terrain features or other local factors. Our system will address this by being able to be left on site to collect data for that specific location.

### **Requirements:**

- Must be rugged, needs to be able to withstand extended exposure to the elements and wildlife.
- Must have enough data capacity to be able to store temperature, solar energy, and wind speed over three months.
- Must be able to store and retrieve data from the system via removable storage, such as an SD card or USB flash drive.
- Must use a calibrated photovoltaic cell or a solar panel to measure available solar energy at the location.
- Must use 40C anemometer to measure the wind speed for assessment of available wind power at the location at a height of at least 5m.
- Must use thermistor voltage divider for temperature measurement at the location.
- Must be designed for minimal power consumption, as it will be required to operate autonomously for up to 3 months.
- All components must be able to withstand temperatures between 32°F and 105°F.
- All components must be able to withstand exposure to rain, so packaging of the device should be waterproof or water-resistant.
- Anemometer/Light Sensing Device should be able to withstand wind speeds of up to 60mph while remaining operational.

- Anemometer/Light Sensing Device must relay data to the housing via the PIC microprocessor so that data can be processed and stored.
- There should be no special tools required for by the end-user for assembly/setup.
- Cables should be housed in a durable conduit of some type, whether plastic or metal.

## **Summary**

The current status of our project is as follows. We have done research into measurement methods for solar and wind energy, and researched how we can best determine the electrical energy potential from solar and wind energy using formulas relating actual power present to available electrical power that can potentially be generated. We have selected the best anemometer, photovoltaic panel, and temperature sensor for our purposes, taking into account ease of calibration and cost. We have also selected a battery for powering our device which we believe will best meet our needs. We have written a rough data-logging program in C code for the PIC18f4620 Microcontroller which will allow us to log several Analog to Digital inputs to the PIC via serial port on a PC using hyperterminal. We are currently working on calibration of the input to the PIC so that we can best determine the energy availability using the devices we have chosen for this purpose. This will require some work with signal processing and programming which we are currently addressing.

<b>Budget</b>					
<b>Item</b>	<b>Description</b>	<b>Purpose</b>	<b>price/unit</b>	<b># of units</b>	<b>total</b>
Brunton Solarflat2 Solar Panel	6V, 2 Watts, weatherproof	charging the 6V battery	\$25.00	Already Purchased	\$0.00
Rechargeable Battery LC-R0612P1	6V golf cart battery, Lead Acid	store energy in a chemical reaction to power PICs and data logger	\$30.80	Already Purchased	\$0.00
Electronic Components	Resistors, Capacitors, Solder, Wiring, etc.	Building circuitry	\$0.00	In house at NDSU	\$0.00
Materials	lumber, metal fasteners, mounting equipment, wires, conduit,	building project	\$50.00	1	\$50.00
PIC 16F876A	micro processor	logging/interpreting data	\$7.70	Already Purchased	\$0.00
Enclosure	weather/animal resistant enclosure	houses: battery, PICs, Temperature sensor, and data logger	\$100.00	1	\$100.00
DS1620 Temp Sensor	IC measures temperature	logging accurate temperatures on environment	\$5.95	Already Purchased	\$0.00
Anemometer	40C	measuring wind speed and direction.	\$100.00	Already purchased	\$0.00
PCB Fabrication	A solder-masked PCB fabricated by an external fab house	Circuit board to hold our circuit components and mount all connectors	\$60.00	1	\$60.00
Flash Drive or SD Card	USB 8MB flash Drive or SD card	storing data points for (anemometer, solar panel, and thermal sensor)	\$10.00	1	\$10.00
		<b>TOTAL</b>	<b>\$389.45</b>	<b>TOTAL Remaining</b>	<b>\$220.00</b>